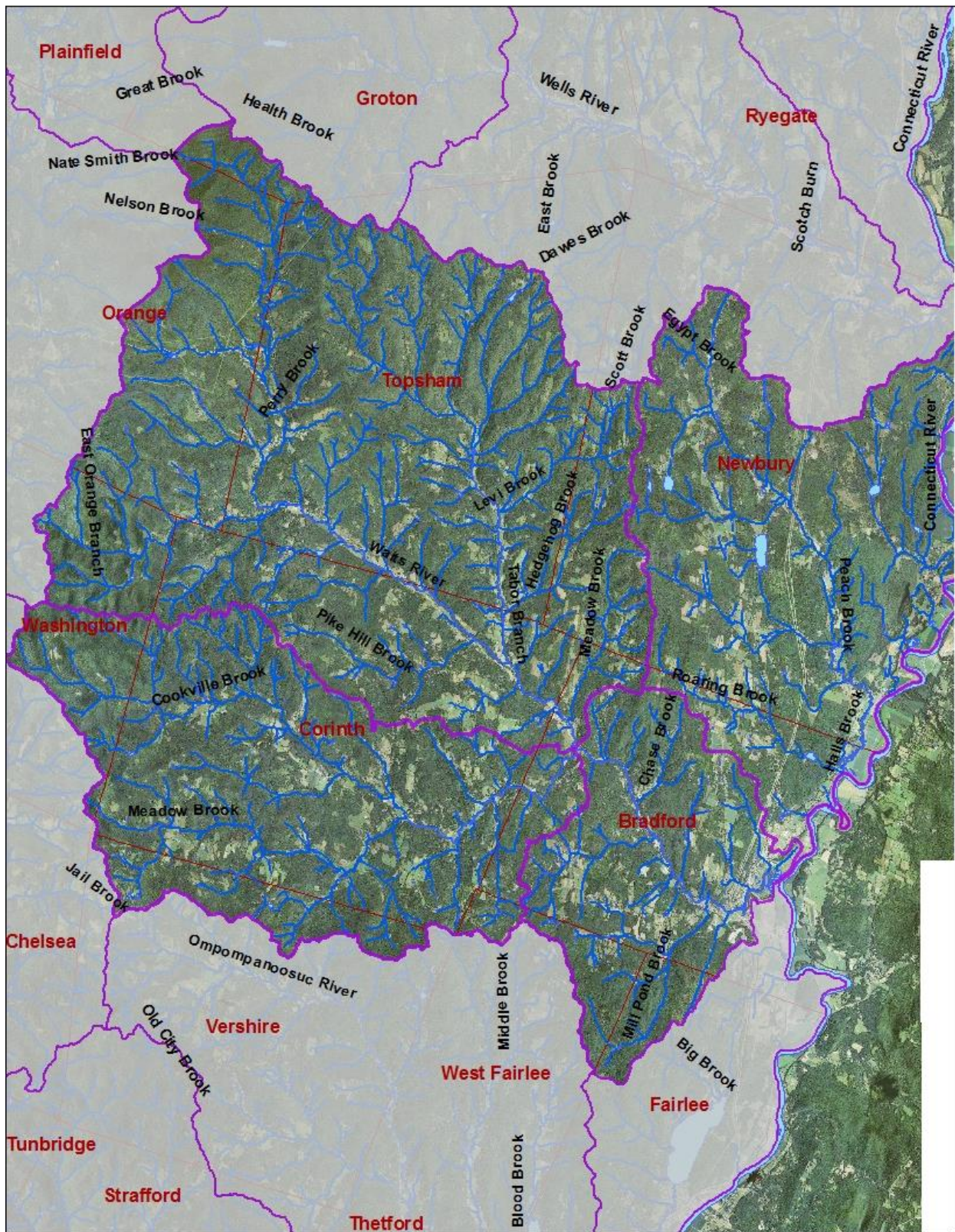


# Waits River including Halls Brook Watersheds

August 2014



## Table of Contents

Waits River Watershed.....	1
Earlier Information on the Waits River Watershed.....	1
General Description .....	1
Special Uses, Features, and Values of the Waits Watershed.....	1
Boating.....	1
Swimming .....	1
Biological Diversity .....	2
Waits River and Tributaries Summary of Segments with Impacts .....	3
Assessment Information for the Waits River Watershed.....	4
Biological Monitoring .....	4
Physical Assessment of the Waits River and its Tributaries.....	6
Fishery Assessment for the Waits River Watershed .....	8
Landfill Monitoring Data .....	9
Sources of Information.....	11
Newbury-Bradford Streams to the Connecticut .....	12
Earlier Information on the Newbury & Bradford Streams .....	12
General Description .....	13
Monitoring and Assessment Information.....	13
Biological Monitoring .....	13
Special Uses, Features, and Values of the Halls Brook Watershed .....	14
Swimming, Fishing, Boating .....	14
Biodiversity.....	14

# Waits River Watershed

## Earlier Information on the Waits River Watershed

The last time that a formal assessment report was done on the Waits River was in 1999 as the Basin 14 – Stevens, Wells, Waits, Ompompanoosuc Water Quality and Aquatic Habitat Assessment Report. Following that there was the Basin 14 “Little Rivers” Water Quality Management Plan dated June 2008. Updated information was used in the formation of that plan. There were also Phase 1 and Phase 2 geomorphic assessments done on the Waits River mainstem and some of its tributaries from 2007 to 2009. The work and the results are summarized in a report dated January 12, 2010. This 2013 assessment is a further update in preparation for the 2014 Basin 14 plan preparation.

## General Description

The Waits River originates below the slopes of Signal, Burnt and Butterfield Mountains in the southern part of Groton State Forest. It is 23 miles long and flows southerly for about 8 or 9 miles before taking a turn and flowing southeasterly for 14 or 15 miles before entering the Connecticut River in Bradford. The total drainage area of the watershed is approximately 144.3 square miles or 92,400 acres.

The two largest tributaries to the Waits River are the South Branch and the Tabor Branch. The Tabor Branch is 10 miles long and drains 28.4 square miles or 18,180 acres. It flows from the base of the hills in northwestern Topsham south, southeast, then south again converging with the Waits River just below East Corinth. The South Branch of the Waits River is 10 miles long and drains 44 square miles or approximately 28,160 acres. The South Branch is formed by the confluence of Cookville and Meadow Brooks in the southeastern part of Corinth and flows easterly then northeasterly meeting the Waits River on the eastern edge of Bradford.

## Special Uses, Features, and Values of the Waits Watershed

### **Boating**

For boating, the Waits is rated highly important because it is a good continuous stretch of whitewater in an attractive rural valley. During a medium flow of water, the river is rated Class II, with some Class III drops. The most continuous rapids are adjacent to Wrights Mountain, below the confluence with the South Branch.

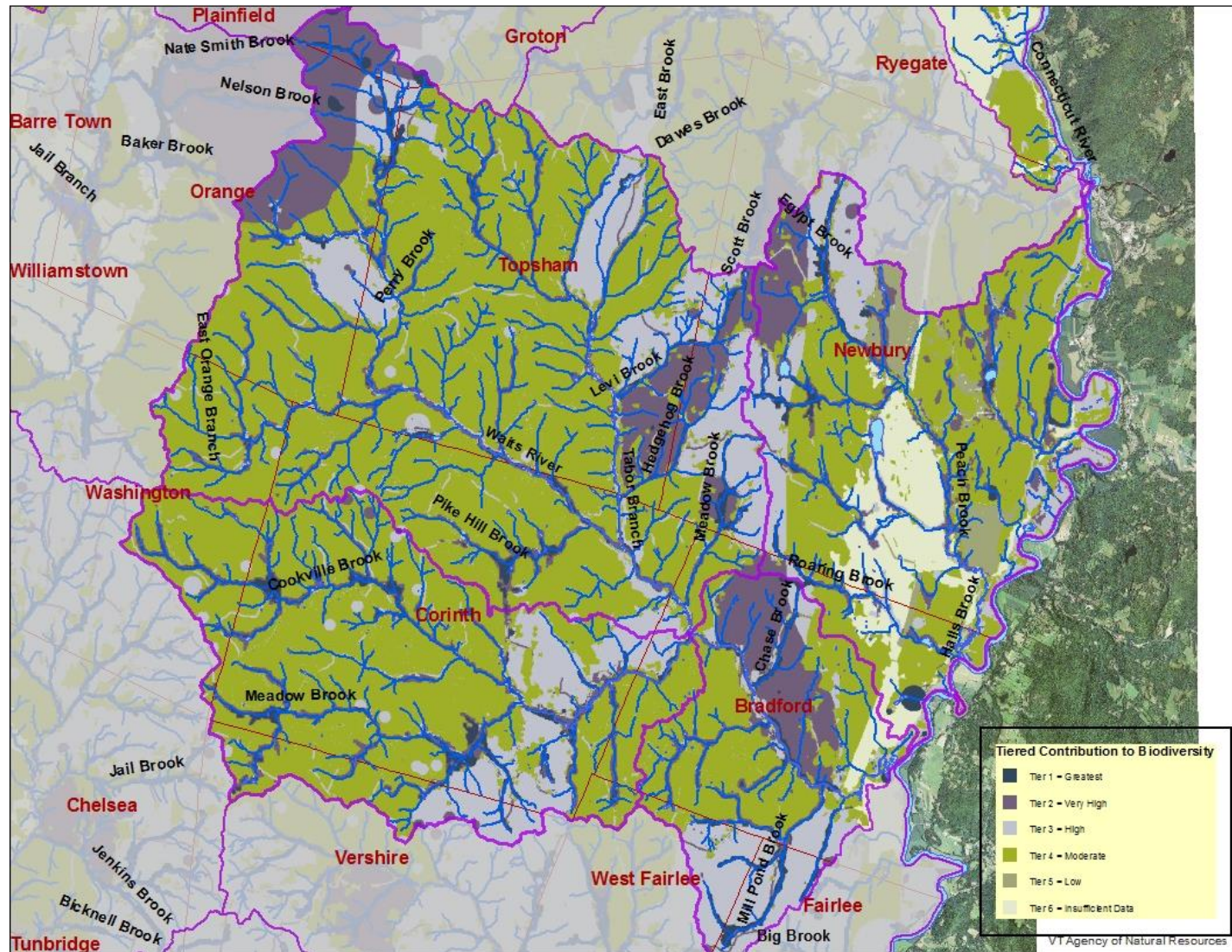
### **Swimming**

Six swimming holes have been formally documented on the Waits River. One of the swimming holes, located west of Bradford Village, is state significant due to its depth of 20 feet. Swimming holes or bathing spots are also located on the Tabor Branch in East Corinth and in East Topsham. The swimming hole in East Topsham Village is in a ravine, containing scenic falls, cascades, nice rocks and small pools. Most of the swimming holes are accessed over private land.



## **Biological Diversity**

As shown in the map below, there are three areas in the Waits River watershed/Halls Brook watersheds that have a very high contribution to biological diversity (the purplish color in the map below.)



**Figure 1. Areas of the Waits and Halls Brook watersheds and their relative contribution to biological diversity.**

### ***Uppermost Waits River and tributaries area***

The uppermost Waits River and tributaries area in Orange and Plainfield that shows as very high contribution to diversity in the map above contributes to biological diversity because it has a rare physical landscape (granitic high hills/low mountains); it has a very large habitat block (10 to 50,000 acres) and related, is considered an “anchor block” with greater than 10,000 acres in terms of landscape connectivity; and it has an uncommon natural community, a vernal pool, and mast stands among other characteristics.

### ***Chase Brook Corridor and Northeast of the Lower Waits River in Bradford***

The Chase Brook corridor in Bradford provides Tier 1 or the “greatest” contribution to biodiversity while the area east and north of the Waits River centered on Chase Brook provides a “very high” contribution to biodiversity (again see purple coloring on map above). This area includes a representative physical landscape (dissected low to mid-elevation calcareous/metamorphic hills); a rare physical landscape adjacent to the Waits River (glacial sediments along major tributaries); and a habitat block in the category of 501 to 5000 acres and connecting lands (of < 2000 acres).

### ***Between Levi Brook and Hedgehog Brook plus Southeast of Egypt Brook***

The third area shaded on the map above with a very high contribution to biological diversity is the area east of Tabor Branch that is generally between Levi Brook and Hedgehog Brook in the Waits River watershed plus an area in the upper Halls Brook watershed that lies north of Round, Muddy, and Long Ponds and is largely east of Egypt Brook. This area provides a “very high” (Tier 2) contribution to biological diversity because it has a large habitat block (501 to 5000 acres category); it has a representative physical landscape (dissected low to mid-elevation calcareous/metamorphic hills); and connecting lands (of < 2000 acres).

## **Waits River and Tributaries Summary of Segments with Impacts**

Stream or Lake Segment	Milage & Status	Pollutant	Source	Other information
Pike Hill Brook from mouth upstream	4.0 miles <b>Impaired</b> – Part A list	metals	Former Pike Hill Mine	
Tabor Branch Trib #6	0.1 mile <b>Impaired</b> – Part A list	undefined	Ag runoff	
Cookville Brook Trib #4 – rm 1.0 up to rm 1.7	0.7 miles <b>Impaired</b> – Part A list	metals	Drainage from abandoned Pike Hill Mile	Possible some enrichment/organic material as well
Waits River below Bradford dam	0.3 mile <b>Altered</b> – Part F list	flow alterations, low flows	Bradford dam	This facility has a FERC exemption
Waits River below South Branch confluence to mouth	6.2 miles <b>Stressed</b> –	sediment, temperature, habitat alteration	Channelization post-floods, bermings, rip-rapped banks	Waits River watershed hard hit in 1970s, 1998, 2011
Waits River, from South Branch up to Tabor Branch	4.0 miles <b>Stressed</b>	temperature, habitat alterations	Post-flood channelization, loss of riparian vegetation	Fishery is affected by the diminished habitat



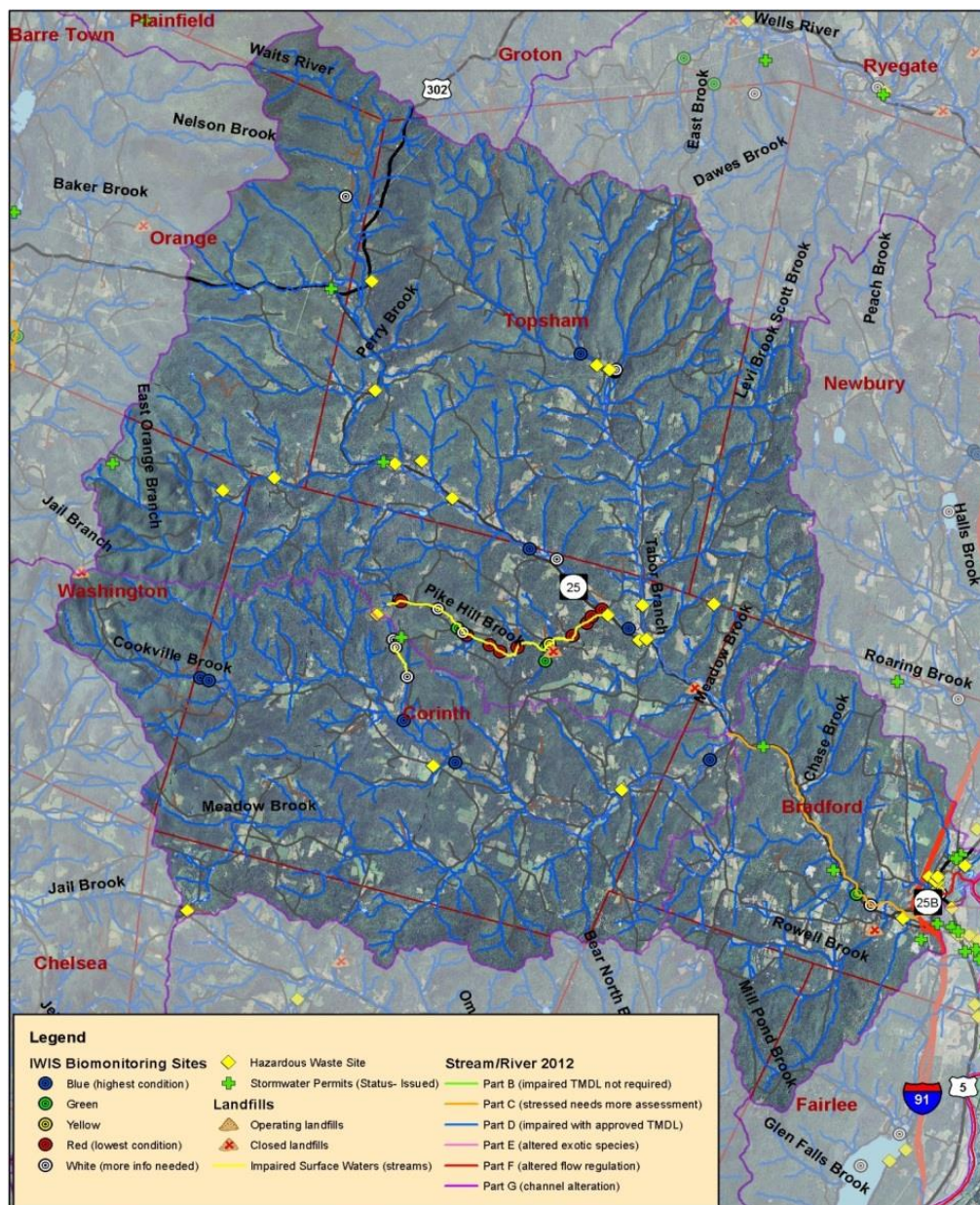


Figure 2. Waits River watershed showing biomonitoring sites (colored dots), landfills (brown with red x), hazardous waste sites (yellow diamonds), and assessment condition of stream segments (impaired is bright yellow, altered is red, stressed is orange).

## Assessment Information for the Waits River Watershed

### Biological Monitoring

Below are the biological monitoring results of the last twelve years in the Waits River watershed. The biological community in the Waits River mainstem has only been sampled at three locations in the last ten years. At rivermile 2.4, which is above interstate 91 and off Route 25, both the fish and bug communities were sampled in 2012 and were in “good” and “excellent” health respectively.

**Table 1. Macroinvertebrate and fish sampling results in the Waits River watershed**

River/stream	Rivermile	Year	Result	Community
Waits River	2.4	2012	excellent	bugs
Waits River	2.4	2012	good	fish
Waits River	10.3	2002	excellent	bugs
Waits River	10.3	2005	very good	bugs
Waits River	13.0	2005	very good	bugs
Pike Hill Brook	0.1	2005	fair	bugs
Pike Hill Brook	0.3	2002	poor	bugs
Pike Hill Brook	0.3	2002	poor	fish
Pike Hill Brook	0.4	2005	fair-poor	bugs
Pike Hill Brook	0.4	2005	poor	fish
Pike Hill Brook	0.4	2007	fair	bugs
Pike Hill Brook	0.9	2005	good-fair	bugs
Pike Hill Brook	0.9	2007	fair	bugs
Pike Hill Brook	1.3	2007	good-fair	bugs
Pike Hill Brook	1.4	2005	fair	bugs
Pike Hill Brook	1.4	2007	good	bugs
Pike Hill Brook	1.9	2007	poor	bugs
Pike Hill Brook	2.0	2007	fair	bugs
Pike Hill Brook	2.1	2005	poor	bugs
Pike Hill Brook	2.1	2007	poor	bugs
Pike Hill Brook	2.5	2002	poor	bugs
Pike Hill Brook	2.5	2002	poor	fish
Pike Hill Brook	2.6	2005	poor	bugs
Pike Hill Brook	4.0	2007	poor	bugs
Pike Hill Brook Trib #3	0.2	2007	good	bugs
Powder Spring Brook	0.1	2008	excellent	bugs
Tabor Branch Trib 5	0.5	2008	good	bugs
Tabor Branch Trib 6	0.0	2007	good-fair	bugs
Tabor Branch Trib 6	0.1	2012	fair	bugs
Cookville Brook	1.5	2007	excellent	bugs
Cookville Brook	8.1	2007	excellent	bugs
Cookville Brook	8.2	2007	exc-vgood	bugs
Cookville Brook Trib #4	0.1	2007	exc-vgood	bugs
Cookville Brook Trib #4	0.9	2005	good-fair	bugs
Cookville Brook Trib #4	1.7	2007	poor	bugs
Cookville Brook Trib #4	1.8	2007	good	bugs

**Table 2. Sampling site locations in the Waits River watershed**

River or stream	River-mile	description
Waits River	2.4	Located above I-91 about 0.8 miles, below a campground and at a pull-off on Route 25 at a bend in the river
Waits River	10.3	Located above snowmobile suspension bridge about 600 meters above bridge to East Corinth
Waits River	13.0	Located at Route 25 crossing above Pike Hill Brook confluence
Pike Hill Brook	0.1	Located just above confluence with the Waits River about 50 meters, below Route 25.
Pike Hill Brook	0.3	Located above Route 25 bridge about 1/3 mile.
Pike Hill Brook	0.4	Located adjacent to Brook Road just as it nears the stream up from Route 25.
Pike Hill Brook	0.9	Located below Miller Road.
Pike Hill Brook	1.3	Located immediately below Pike Hill Road crossing as stream becomes depositional
Pike Hill Brook	1.4	Located above Pike Hill Road crossing about 500 feet, above a tributary from a small pond to the north
Pike Hill Brook	1.9	USGS site 4E, between two large wetland areas along the brook
Pike Hill Brook	2.1	Located in a riffle area immediately above a low gradient marshy reach south of Pike Hill Road.
Pike Hill Brook	2.5	Located below old timber dam below site 2.6 in a high gradient gorge area
Pike Hill Brook	2.6	Located below bridge of Flanders Road crossing, first bridge below mine. (not sure road name correct)
Pike Hill Brook	4.0	Located above Richardson Road, near USGS gage station.
Pike Hill Brook Trib #3	0.2	Located at Brook Road
Powder Spring Brook	0.1	Sampled 200 meters above confluence with Tabor Branch.
Tabor Branch Trib 5	0.5	Off Hart's Road at a concrete culvert.
Tabor Branch Trib 6	0.0	Located 50 feet from confluence with Tabor Branch at town garage.
Cookville Brook	1.5	Located below Center Road 500 meters.
Cookville Brook	8.1	Sampled adjacent to Cookville Road about 200 meters below town line.
Cookville Brook	8.2	Located immediately below culvert on Center Road above wetland area.
Cookville Brook Trib #4	0.1	At downstream end of first wetland area from mouth - off road. Note USGS sampled depositional and riffle at this site.
Cookville Brook Trib #4	0.9	Located below log road crossing above beaver pond wetland.
Cookville Brook Trib #4	1.7	Below geologic breakout from copper mine.
Cookville Brook Trib #4	1.8	Located above geologic breakout from copper mine USGS Site 10A

**Physical Assessment of the Waits River and its Tributaries**

Stream geomorphic assessment work was done by Redstart Forestry and Consulting in partnership with the Bradford and Corinth Conservation Commissions and the Waits River Watershed Council from 2007 to 2009. Phase 1 assessment was done preliminarily on



470 reaches with more assessment on 64 of these reaches. Phase 2 field assessments were done on 19 reaches, broken into 28 segments, of the Waits River, Tabor Branch, South Branch, Meadow Brook and Cookville Brook. The final determinations for the segments are shown in the table 3.

Detailed maps and descriptions can be found in the *Waits River Watershed Phase 1 and 2 Stream Geomorphic Assessment 2007 – 2009*, January 12, 2010 report by Redstart Consulting.

**Table 3. Physical condition of Waits River and tributaries**

Stream name	Phase2 SegmentID	Length	Habitat Condition	Geomorphic Condition
Cookville Brook	T1.06S1.01A	3517	Good	Fair
Cookville Brook	T1.06S1.01B	1896	Fair	Fair
South Branch Waits River	T1.01-	3017	Fair	Fair
South Branch Waits River	T1.02-	4717	Good	Fair
South Branch Waits River	T1.03-	2136	Fair	Fair
South Branch Waits River	T1.04-	3623	Good	Fair
South Branch Waits River	T1.05A	10868	Fair	Fair
South Branch Waits River	T1.05B	2561	Fair	Fair
South Branch Waits River	T1.06-	1851	Fair	Fair
South Branch Waits River	T1.07-	3786	Good	Fair
South Branch Waits River	T1.08-	1898	Good	Good
South Branch Waits River	T1.09A	3159	Fair	Good
South Branch Waits River	T1.09B	1889	Good	Fair
South Branch Waits River	T1.09C	2112	Good	Good
Tabor Branch	T2.01-	848	Good	Fair
Tabor Branch	T2.02A	1886	Fair	Fair
Tabor Branch	T2.02B	725	Good	Good
Tabor Branch	T2.02C	2058	Fair	Fair
Waits River	M03-	1065		
Waits River	M04A	1721		
Waits River	M04B	6332	Fair	Fair
Waits River	M05A	9903	Fair	Poor
Waits River	M05B	3789	Fair	Fair
Waits River	M06A	4198	Fair	Fair
Waits River	M06B	3534	Fair	Fair
Waits River	M07-	6666	Fair	Fair
Waits River	M08-	6469	Good	Fair
Waits River	M09A	1199	Poor	Fair
Waits River	M09B	3191	Fair	Fair
Waits River	M10-	4198	Good	Fair

Of the 28 segments of the 19 reaches that were part of the Phase 2 geomorphic assessment, 23 segments were in "fair" condition; 1 segment was in "poor" condition; and 4 segments were in "good" condition. Historic changes in the watershed and stream including widespread land clearing and damming and flow regulation for mills in addition to straightening and dredging that occurred especially after flood events have all affected the streams' stability.

The habitat condition was not quite as bad but still indicated a diminished stream habitat. Of the 28 segments assessed for habitat, 11 were in "good" condition, 16 were in "fair" condition, and one was in "poor" condition. These habitat condition assessments in part explain the impacts to the wild trout fishery discussed below.

### **Fishery Assessment for the Waits River Watershed**

The Waits River basin is home to a diversity of fish species, some which support popular recreational fisheries. The vast majority of the streams within this watershed provide suitable habitat which support naturally reproducing, i.e. "wild" brook trout populations. Wild populations of native brook trout flourish in the colder, higher elevation streams and in the mainstem above East Corinth. Lower reaches of some tributaries and much of the mainstem support low populations of brook trout, likely due to temperature and habitat limitations. In 2007, temperature monitoring by VDFW observed temperatures exceeding 80° F in three stations between East Corinth and Route 25B in Bradford. Naturalized populations of wild brown trout are occasionally observed in low numbers. Naturalized populations of wild rainbow were once sustained in the Waits River or its tributaries, although none have been observed since 1993.

Tributary streams of the Waits River basin are managed as wild trout waters, i.e. are not stocked with hatchery-reared trout. The Department of Fish and Wildlife also stocks "catchable" size hatchery-reared rainbow trout to supplement recreational fisheries in the Waits from East Corinth to Bradford.

Trout from mainstem reaches of the Waits River and its larger tributaries may migrate into smaller tributary streams to spawn or seek refuge during stressful environmental conditions. These movements may be localized or may involve large distances. For example, during warm periods in the summer, trout often migrate to coldwater refuges such as the mouths of tributary streams or to areas of groundwater inflow. Likewise, trout may migrate in the fall to areas providing suitable overwintering habitat.

The lowest reach of the Waits River is a low gradient backwater of the Connecticut River and supports a diversity of fish species common to the larger receiving water. The Vermont Department of Fish and Wildlife maintains a formal public access area in this area.

Lake and pond habitat in the Waits basin is extremely limited. There are no significant standing waters with formal public access areas.

### ***Existing Uses for Fishing***

In 2000, the VDFW conducted a statistically designed, season-long angler creel survey on a 15.5-mile reach of the Waits River mainstem from Rte 25/302 to the Bradford Dam. Angler activity estimates (i.e. angler hours/mile) was documented throughout the entire reach (Covington 2000).

The VDFW contracted with Cornell University's Human Dimensions Unit to conduct a survey of Vermont angler activity and opinions in 2010. The results of this survey indicate that 60% of Vermont anglers fish for trout in small streams and beaver ponds, further reporting that 44,455 anglers expended a total of 390,313 days fishing these waters in 2009. These important fisheries are distributed throughout the state and are widely available within the Waits watershed. Based upon fish population surveys conducted by VDFW these fisheries exist in the following waters:

- Waits River upstream of Rte 25/302\*
- Riddle Pond Outlet\*
- East Orange Branch\*
  - Lime Ember Brook
- Pike Hill Brook
- Tabor Branch\*
  - Powder Spring Brook\*
  - Levi Brook\*
  - Hedgehog Brook\*
- Meadow Brook\*
- South Branch
  - Meadow Brook
  - Cookville Brook
  - Center Brook
- Chase Brook
- Mill Pond Brook
  - Rowell Brook

### ***Very High Quality Waters***

The waters marked with an asterisk above meet VHQW standards for wild brook trout populations ( $\geq 1000$  fish /mile or  $\geq 20$ lbs/acre). Future surveys may provide additional waters to this list.

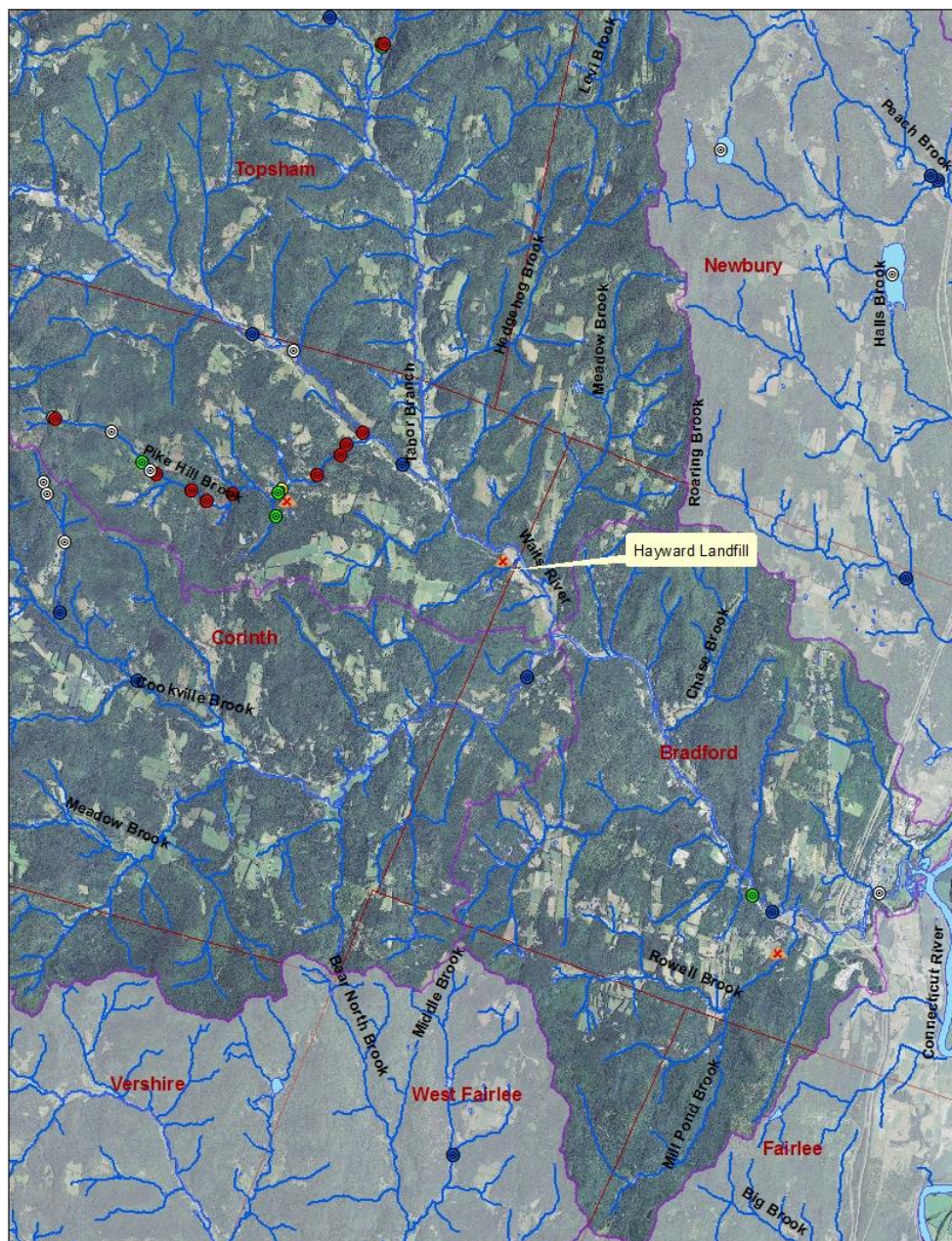
### **Landfill Monitoring Data**

There are at least three old landfills in the Waits River watershed including the Bradford Landfill, Corinth Landfill, and the Hayward Landfill. There has been no water quality monitoring associated with the Corinth and Bradford landfills, however, there has with the Hayward Landfill. The Hayward Landfill was a private landfill that operated from 1982 to 1991. In 1991, the landfill was closed and capped with a geomembrane landfill cap then covered with sand, soil, and vegetation. Drainage systems were installed and monitoring wells put in as well. Since 1992, there has been groundwater monitoring at three to four wells and surface water monitoring at one to two sites (except for a gap between 1999 and 2005 when there was no surface water monitoring).



Groundwater sampling in the early and mid-1990s found toluene and some metals, especially iron, manganese, and zinc at levels above standards or at elevated levels. There were also some detects of chloroethane and cis-1,2-dichloroethene in the mid-1990s samples. Later sampling from the late 1990s to the present found only the iron and manganese persistently elevated.

Surface sampling of volatile organic compounds (VOCs) occurred until 1998 and metals were sampled until 1999. VOCs were not found in the surface water samples and this was likely why sampling for them at the surface water sites ceased. In 2005, surface water sampling for metals started again at one of the two surface water sites. Iron and manganese were high or elevated in some samples but there is not a consistent pattern.



The latest certification for this landfill is for the period May 2010 to April 2015 but the consultant and landowners have requested “cessation of post closure care” for Hayward Landfill but need to formally apply. If approved then the landfill goes into “custodial care”, which has no monitoring requirements but a “minimal level of site management” required. The latest correspondence on this landfill was in September 2013.

## **Sources of Information**

1. ANR Department of Environmental Conservation, Biomonitoring Section – data and assessment on aquatic communities in Stevens, Wells, Waits, and Ompompanoosuc watersheds.
2. ANR Department of Fish and Wildlife, Fishery Biologist, St. Johnsbury – descriptions of the fishery resource in the Stevens and Wells watersheds.
3. ANR Department of Fish and Wildlife, Fishery Biologist, Roxbury – descriptions of the fishery resource in the Waits and Ompompanoosac watersheds.
4. ANR Department of Fish and Wildlife, Natural Heritage Program – data and information on rare, threatened, and endangered species, significant natural communities, areas of high biological diversity.
5. *Waits River Watershed Phase 1 and 2 Stream Geomorphic Assessment 2007 – 2009*. Redstart Consulting. January 12, 2010 report.



## Newbury-Bradford Streams to the Connecticut

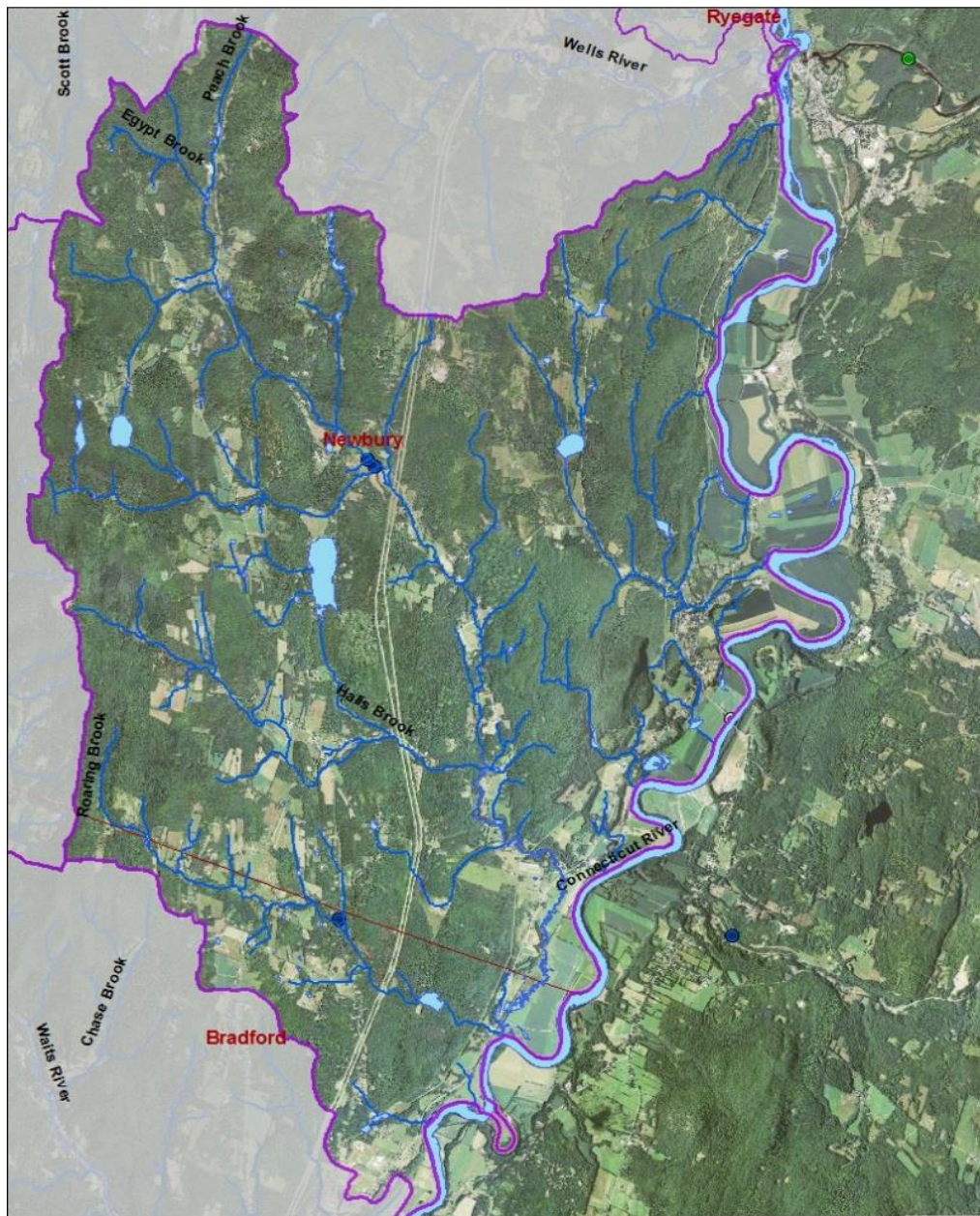


Figure 3. Tributaries from Newbury and Bradford to Connecticut River

### Earlier Information on the Newbury & Bradford Streams

Harriman Brook, Halls Brook and its tributary, Peach Brook, and Roaring Brook were last described and assessed starting on page 33 in the [\*Basin 16 – Northern Connecticut River and Direct Tributaries Water Resources, Water Quality, and Aquatic Habitat Assessment Report done in March 2011\*](#). This waterbody (VT16-19 in Vermont DEC jargon) will be assessed and part of the planning process for Basin 14, which includes the Stevens, Wells, Waits, and Ompompanoosuc River watersheds. It seems most closely linked with the Waits River watershed and hence is part of this assessment update.



## General Description

Harriman Brook begins at Harriman Pond, flows through a wetland and field, then tumbles southeasterly down to the Connecticut passing through the village of Newbury on its way. Scotch Hollow Road follows the brook too closely and crosses it several times.

Halls Brook originates at the 85 acre Halls Lake and flows southeasterly overall down to the Connecticut River. From the lake down, Halls Brook: goes under Interstate 91; winds through an alder swamp; cascades along Snake Road; has a pool behind an old dam for swimming and fishing; is fast below the dam for a stretch; passes through agricultural land; goes under Route 5; and meets the Connecticut. Its length is six miles and it drains a 26.5 square mile watershed.

Peach Brook is a very significant tributary to Halls Brook. It starts up in Scotch Hollow, with Egypt Brook as an early tributary to it, and flows southeasterly 8.5 miles before it joins Halls Brook. It is a clear, healthy, intact stream with either wetland vegetation or forest adjacent to it for much of its length. There are nice cascades and moss-covered boulders downstream of Moore Hill Road.

Roaring Brook begins in Newbury but then flows south into Bradford then easterly and southeasterly through a wetland; under I-91; through Blodgett Pond; and into the Connecticut River. It is about 5.5 miles long and drains a five square mile watershed.

## Monitoring and Assessment Information

### Biological Monitoring

Wbid	Stream	Station & Community	Date	Assessment
VT16-19	Roaring Brook	2.0 - bugs	10/16/2012	Exc-very good
VT16-19	Roaring Brook	2.0 - bugs	9/06/2013	Excellent

### ***Roaring Brook***

Roaring Brook was sampled in 2012 and 2013. The 2013 sample verified the Very High Quality water/Class A aquatic life use of this stream. The community is dominated by EPT taxa and the EPT/EPTc ratio is high despite that Diptera were the dominant order and two Chironomidae were in the top 10 taxa. However, four of six top dominant taxa were water quality sensitive, which resulted in a low BI value.

The periphyton assessment shows moss dominate this community. No macro-algae observed, and the canopy cover is 90% offering good stream shading. The substrate habitat was very low in sand and the silt rating was 1/5. Embeddedness was excellent at <5 % both years. Water chemistry samples show the stream has moderate alkalinity of about 50 mg/l and is low in nutrients. Chloride does show a slight influence by road salt at about 10 mg/l.

## Special Uses, Features, and Values of the Halls Brook Watershed

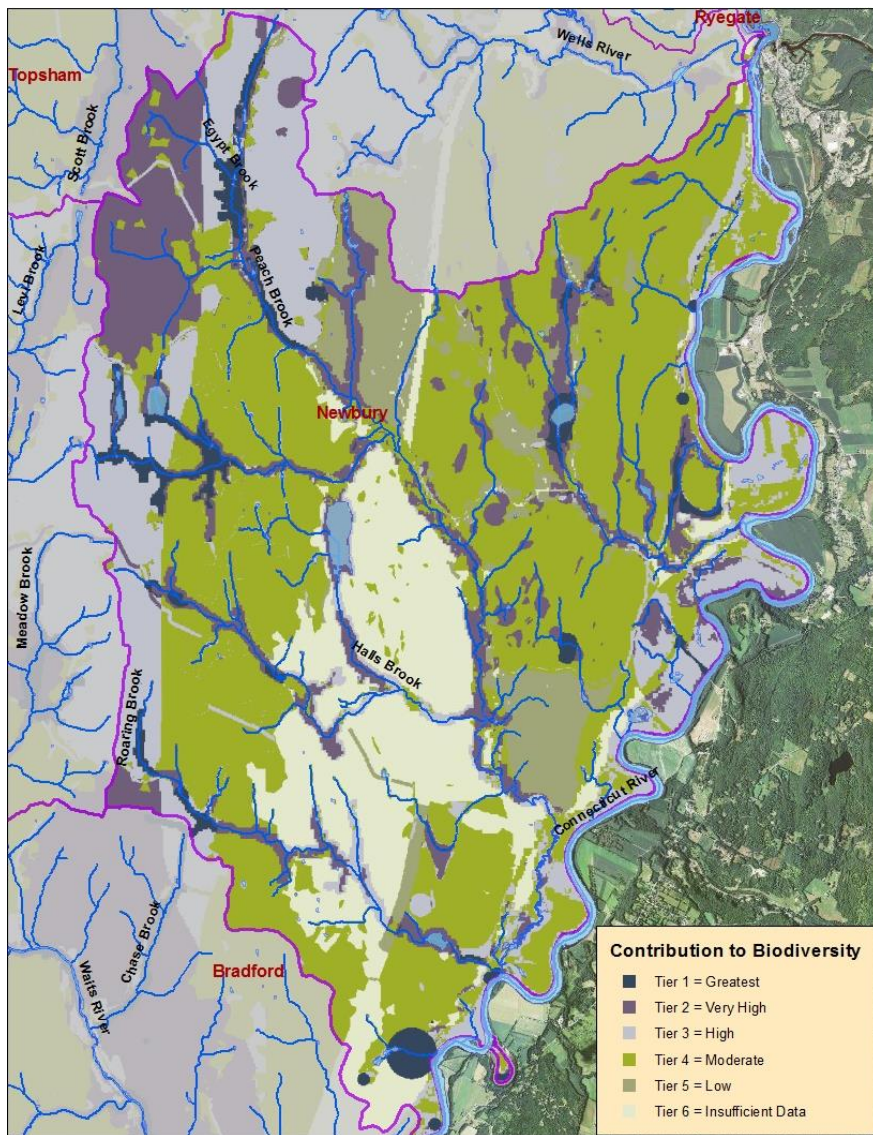
### Swimming, Fishing, Boating

Halls Brook in Newbury has a steep section along Snake Road that is a nice set of cascades that end in a pool above an old dam. People swim and fish in the pool and also boat and float below the dam where there is a stretch of rapids in medium to higher flows.

### Biodiversity

A significant area in the northwest corner of the Peach and Halls Brook watershed has a rating of “very high” contribution to biological diversity (see the deep purple areas on map below). Several stretches of unnamed stream corridors have a “very high” to “greatest” contribution shown below.

The components that make the Peach Brook headwater area so diverse include the information that it is part of a habitat block of 5001 to 5000 acres, that it is a connecting



block of 2000 to 10,000 acres, and it is a representative physical landscape of low to mid calcareous/metamorphic hills. The stream corridors that make a very high or great contribution to biodiversity have large intact riparian areas and some have wetland communities.

The stream corridors that make a very high or great contribution to biodiversity have large intact riparian areas and some have wetland communities.